SD11
.U5963
No. 14

United States Department of Agriculture

Forest Service
Southern Region

HOW TO

CLASSIFY FUSIFORM RUST GALLS ON INFECTED LOBLOLLY AND SLASH PINES

Prepared by:

C. H. WALKINSHAW, Principal Plant Pathologist, USDA Forest Service, Southern Forest Experiment Station, Gulfport, MS 39505

R. L. ANDERSON, Manager, Resistance Screening Center, Forest Pest Management, Southern Region, USDA Forest Service, Asheville, NC 28802

Protection Report R8-PR 14 December 1988

HOW TO
CLASSIFY FUSIFORM RUST GALLS ON INFECTED LOBLOLLY AND SLASH PINES

Fusiform rust, caused by *Cronartium quercuum* (Berk.) Miyabe ex Shirai f. sp. *fusiforme* is the most serious disease of yellow pines in the Southeastern United States. Since 1930, numbers of trees infected by fusiform rust have grown because of increasingly intensive silvicultural practices and increasing numbers of the alternate host (oak). More than 138 million acres have pines with stem or branch galls, and 2½ million acres, or about 6 percent of slash (*Pinus elliottii* Engelm. var. *elliottii*) and loblolly (*P. taeda* L.) stands in the South, have more than 50 percent of their trees infected. Trees that are infected by age 5 often die. Later infections cause breakage during storms and reduce bole quality.

As fusiform rust hazard increases, the need for effective controls become more urgent. Judicious selection of species for planting, alterations in site preparation, salvage removal of infected stems in the field, and chemical control in nurseries can help to reduce losses. The most promising way to minimize field losses while growing the most desirable species, however, is by planting resistant stock in areas of high rust hazard.

Some loblolly and slash pine families are genetically resistant to fusiform rust. For years, managers and researchers rated resistance based solely on whether trees in the field were infected. They have known for some time, however, that some infections are more serious than others, and that certain distinctive shapes and sizes of galls are indicators of certain kinds of resistance. For example, galls are more numerous and larger in diameter on susceptible trees than on resistant ones. In thinning infected stands, foresters have long recognized that branch galls are generally less serious than stem galls, and that branch galls more than 12 inches (30 centimeters) from the main stem are not likely to spread to the stem.

Researchers have long recognized that certain types of galls are indicators of a family's probable performance in areas of high rust hazard. If the numbers of families that remain free of rust were ample, interest in other forms of resistance would be slight. In fact, however, numbers of resistant families are severely limited, and all markers of resistance are needed. Therefore, in 1978, the Resistance Screening Center near Asheville, NC, started looking at gall types of greenhouse seedlings. Short galls, fat galls, rough-surfaced galls, and purple spots on stems exposed to infection were some of the symptoms that appeared to be useful in defining resistance. In 1983, we extended our classification of gall types to trees in the field.

Until now, classification of gall types has been largely subjective. This guide, with its color illustrations, is designed to help standardize classification and to help field personnel to recognize gall types that are probable indicators of resistance or susceptibility.

Figures 1 to 4 show symptoms on young seedlings in a greenhouse or nursery environment. They are arranged in order from most to least resistant. Figures 5 to 10 show symptoms in the field, arranged in order from least to most harmful to the infected trees.

SYMPTOMS ON GREENHOUSE SEEDLINGS

Figure 1.—Symptoms without swelling.

Purplish discoloration of stem or needle base tissue indicates rust infection even when no swelling occurs. The green tissue surrounding the discoloration may be slightly swollen and still be classified as this symptom type. This symptom indicates seedling resistance.

Figure 2.—Galls less than 25 mm (about 1 inch) long.

When the galls are less than 25 mm long, seedlings often do not contain fungus in their cambium. In these seedlings recovery from infection is common.

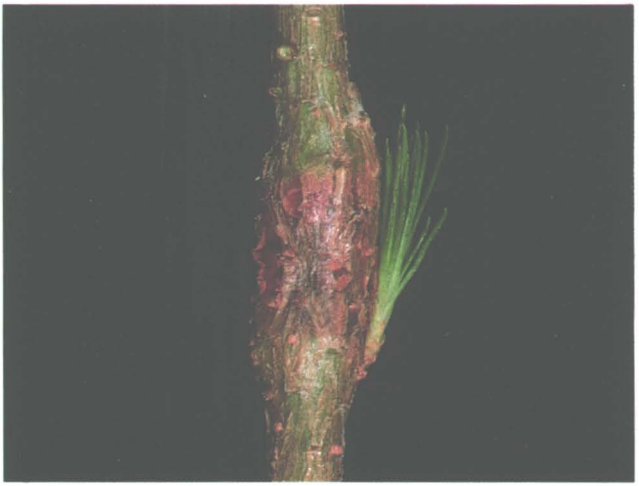


Figure 3.—Rough gall.

More than 50 percent of the gall has a rough or highly discolored surface. The surface is dark purple to brown and may be sunken as compared to the smooth green surface of normal seedlings. This symptom is best as-

sessed before spermagonia (spores) appear because spores create rough bark and so can give false readings. Rough bark suggests resistance.

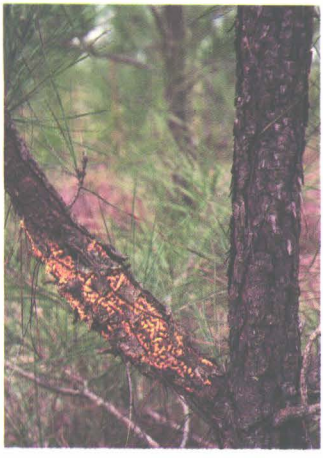
Figure 4.—Fat galls.

Galls are fat when the stem is twice the diameter of a normal seedling. Six months after inoculation, a high proportion of seedlings in susceptible loblolly and slash pine families have fat galls.

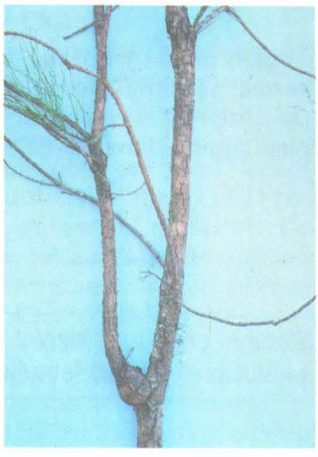
Photos on cover depict branch-to-stem gall (larger photo) and fat gall (smaller photo).

Figure 5.—Branch gall more than 12 inches (30 cm) from the stem.

The edge of the gall is more than 12 inches from the stem. These galls indicate infection, but are not related to mortality of the tree. Exact measurements of distance from the stem to the point of infection would be more descriptive.



6



7

Figures 6 and 7.—Gall on branch within 12 inches (30 cm) of the stem.

Galls may originate on the branch close to the stem, but do not enter the stem before the branch dies. In some cases, the gall grows from the branch toward the stem, but is prevented from entering the stem at the union of the branch. In others, the gall grows away from the stem, or does not grow at all after its initial appearance. Mortality from these galls is unlikely.

8

9

Figures 8 and 9.—Two examples of branch-to-stem gall.

Galls may grow from a branch into the stem. When branch-to-stem galls kill trees it is because they gradually girdle the stem over time. Multiples of these galls can form bush growth with loss of apical dominance.

Figure 10.—True stem gall.

This gall is an infection of the terminal shoot of the seedling or the tree. No evidence exists to indicate that the infection could have spread from a branch to the stem. Trees with these galls usually die within 5 years after infection.

VALUE OF GALL CLASSIFICATION

In the greenhouse and the field, proportions of seedlings or trees with particular symptoms are analyzed. These proportions can be used individually, in regression equations, or formulated into indices for comparing families. You can derive equations to predict field performance from greenhouse data. In the past, using proportion galled without identifying gall types often did not distinguish resistant from susceptible pine families in the greenhouse. In effect, percent galled is too coarse a measurement because some gall types actually indicate resistant reactions in the seedling or tree. As many variables as possible should be observed to strengthen the evaluation of the disease. By using the symptoms described in this guide, better separation of pine families can be made, and especially if repeated observations at 3 to 5 years are made in the field.